AMENDMENTS TO THE SPECIFICATION

Please replace paragraph **[0059]** with the following paragraph:

[0059] IMD 12 delivers neurostimulation therapy to patient ~~12~~18 via leads 14A and 14B (collectively "leads 14"). Leads 14 may, as shown in FIG. 1, be implanted proximate to the spinal cord 16 of patient 18, and IMD ~~14~~12 may deliver spinal cord stimulation (SCS) therapy to patient 18 in order to, for example, reduce pain experienced by patient 18. However, the invention is not limited to the configuration of leads 14 shown in FIG. 1 or the delivery of SCS therapy. For example, one or more leads 14 may extend from IMD 12 to the brain (not shown) of patient 18, and IMD 12 may deliver deep brain stimulation (DBS) therapy to patient 18 to, for example, treat tremor or epilepsy. As further examples, one or more leads 14 may be implanted proximate to the pelvic nerves (not shown) or stomach (not shown), and IMD 12 may deliver neurostimulation therapy to treat incontinence or gastroparesis.

Please replace paragraph **[0064]** with the following paragraph:

[0064] Also, programmer 20 may interact with IMD 12 to assess operation and status of the IMD 12. For example, programmer 20 may interrogate IMD 12 to ascertain the charge status of a rechargeable battery power supply within IMD 12. In this manner, programmer 20 may advise patient ~~20~~18 of the current charge status, and indicate when recharge is necessary or advisable. The charge status may be presented to patient 18 on display 28 as a percentage, number, bar representation, or other graphical, textual or iconic representation that conveys to the patient the battery charge status within IMD 12. Of course, display 28 may also convey the battery charge status for batteries within programmer 20 itself, in a similar manner to the presentation of battery charge for IMD 12.

Please replace paragraph **[0066]** with the following paragraph:

[0066] In addition, processor 22 receives user input entered by a user via user input 26 to control various operations performed by patient programmer 20. Processor 22 also controls a telemetry interface 30 to transmit and receive information, such as instructions and status information. In particular, telemetry interface 30 drives one or both of an internal antenna 32 and an external antenna 34 to transmit instructions to IMD 12. In addition, telemetry interface 30 processes signals received by internal antenna 32 and external antenna 34 from IMD 12. Internal antenna 32 is mounted within a housing associated with patient programmer 20, whereas external antenna 34 extends outward from patient programmer 20 via an antenna cable. Notably, as shown in FIG. 1, programmer 20 may include both a display 28 and internal antenna 32.

Please replace paragraph **[0070]** with the following paragraph:

[0070] In order to modify programs and parameter settings and otherwise control IMD 12, patient programmer 20 communicates with IMD 12 via wireless telemetry techniques. For example, programmer 20 may communicate with IMD 12 via RF telemetry. In this manner, patient programmer 20 is used by patient ~~12~~18 to control the delivery of neurostimulation therapy by IMD 12. For telemetry with IMD 12, patient programmer 20 may use either internal antenna 32 or external antenna 34 on a selective basis.

Please replace paragraph **[0072]** with the following paragraph:

[0072] Display 28 and associated display electronic can produce significant electrical and electromagnetic interference capable of degrading the performance of internal antenna ~~22~~32 during telemetry sessions. This interference may be particularly troublesome due to the relatively close proximity of internal antenna 32 to display 28 within the housing of patient programmer 20. For this reason, processor 22 or other control circuitry within patient programmer 20 may be configured to selectively disable, i.e., turn off, display 28 and associated display electronics during RF telemetry with internal antenna 32 to promote more reliable communication. For example, display 28 and display electronics may be temporarily disabled during reception of RF signals, transmission of RF signals, or both, by internal antenna 32.

Please replace paragraph **[0097]** with the following paragraph:

[0097] As further shown in FIGS. 6A and 6B, telemetry head 74 may be formed from molded plastic 76 and include rubberized grip surfaces 84A, 84B. Cable 86 may include strain relief sections 88, 94, a filter 90, and a plug 92 for plugging the cable into a jack provided in patient programmer 20. The jack provided by programmer 20 also couples external antenna 34 to telemetry interface 30, from FIG. 2. Cable 86 carries a conductor that couples to a conductive antenna loop within telemetry head 74. In FIG. 6A, cable 86 appears to be relatively short but can be approximately two to three feet long if desired. The length of cable 86 allows programmer 20 to perform telemetry via external antenna 34 with display 28 enabled. The distance between external antenna 34 and display 28 reduces interference to telemetry generated by display 28.

Please replace paragraph **[0110]** with the following paragraph:

[0110] Display circuit board 104 is then placed over antenna circuit board 106 and coupled to antenna circuit board 106 via electrical connector 107. Front cover 96 is placed over display circuit board 104 to substantially enclose the display and antenna circuit boards 104, 106 within front cover 96 and bottom housing cover 98. In some embodiments, the placement of button moldings 100, 102 over display circuit board 104 prior to the placement of front cover 96 is also automated. After programmer ~~22~~20 is substantially assembled, as described above, software is loaded into a memory 24 via software loading interface 40 through an aperture in front cover 96. A faceplate 68 is then placed over front cover 96 to cover loading interface 40 and expose display 28 for viewing, providing a complete assembly.

Please replace paragraph **[0111]** with the following paragraph:

[0111] FIG. 11 is a perspective view illustrating the patient programmer of FIG. 7 with the top housing cover ~~98~~96, display circuit board 104 and antenna circuit board 106 removed, and an antenna-side view of the antenna circuit board, i.e., a view of the antenna circuit board from a side on which the antenna is mounted. As shown in FIG. 11, antenna circuit board 106 carries internal antenna 32. Internal antenna 32 may have a loop-like structure 110 that defines a central aperture 112. In some embodiments, the loop-like structure 110 may be substantially rectangular. The central aperture 112 may be shaped and sized to permit insertion of one or more batteries placed in battery bay 108 of bottom housing cover 98. Battery bay 108 may protrude into the antenna aperture 112 when programmer 20 is fully assembled. The batteries may rest on the surface of antenna circuit board 106.

Please replace paragraph **[0114]** with the following paragraph:

[0114] For example, antenna 32 may be mounted on a carrier that is welded to bottom housing cover 98. The space between antenna circuit board 106 and loop-like structure 110 is substantially filled by battery bay 108 extending into antenna aperture 112. The placement of battery bay 108 within aperture 112 enables programmer ~~22~~20 to maintain a smaller size. Also, the batteries placed in battery bay 108 within aperture 112 reduce external magnetic interference to internal antenna 32 by providing an RF load to the internal antenna, enhancing noise immunity.

Please replace paragraph **[0115]** with the following paragraph:

[0115] FIG. 13 is a perspective view illustrating a side view of the display circuit board 104 and the antenna circuit board 106. FIG. 14 is a perspective view illustrating a second side view of the display circuit board 104 and the antenna circuit board 106. As shown in FIGS. 13 and 14, the loop-like structure 110 of internal antenna 32 is displaced from the surface of antenna circuit board ~~104~~106. Loop-like structure 110 is mounted to a connector 113 on the surface of antenna circuit board 106. The connector couples internal antenna 32 to telemetry circuitry 30. A jack 114 is provided on antenna circuit board 106 to receive plug 92 from external antenna 34.

~~Plug~~Jack 114 couples external antenna 34 to telemetry interface 30. Display 28 is mounted to the surface of display circuit board 104 and is coupled to display circuitry.

Please replace paragraph **[0117]** with the following paragraph:

[0117] Additionally, display circuit board 104 includes control circuitry, such as processor 22, to control both display 28 and telemetry interface 30. The control circuitry may selectively disable or enable display 28 and related display circuitry based on whether external antenna 34 is connected to programmer 20 via ~~plug~~jack 114. If so, display 28 can be enabled because the electrical and electromagnetic noise generated by the display is less likely to have an adverse effect on telemetry via external antenna 34.

Please replace paragraph **[0132]** with the following paragraph:

[0132] FIG. 22 is a perspective view illustrating a neurostimulation system including a clinician programmer 117, patient programmer 20 and IMD 12. The system includes IMD 12, which delivers neurostimulation therapy to patient ~~12~~18 via one or more implanted leads. Clinician programmer 117 is used by a clinician to program neurostimulation therapy for patient ~~12~~18. In particular, the clinician may use programmer 117 to create neurostimulation therapy programs. As part of the program creation process, programmer 117 allows the clinician to identify parameter settings and electrode configurations that enable IMD 12 to deliver neurostimulation therapy that is desirable in terms of, for example, symptom relief, coverage area relative to symptom area, and side effects.

Please replace paragraph **[0134]** with the following paragraph:

[0134] FIG. 23 is a conceptual side view of an antenna circuit board ~~104~~106 for use in a programmer 20. Antenna circuit board ~~104~~106 is not necessarily in proportion, but provides an illustration of various layers of the circuit board, which is coupled to antenna 110 via a connector 137. Connector 137 couples antenna 110 to circuit board ~~104~~106. As described herein, antenna 110 may have a loop-like configuration that defines an aperture that may accommodate a battery bay. Antenna circuit board ~~104~~106 may include a ground plane 130, a signal plane 132, and a

signal plane 134. Optionally, a power plane carrying operating power may be provided within circuit board ~~104~~106, or distributed across signal planes 132, 134.

Please replace paragraph **[0135]** with the following paragraph:

[0135] Dielectric layer 136 separates ground plane 130 and signal plane 132. Similarly, dielectric layer 138 separates ground plane 130 and signal plane 134. Antenna circuit board ~~110~~106, like display circuit board ~~106~~104, may be constructed from conventional laminated circuit board materials. Ground plane 130 and signal planes 132, 134 may be formed from conductive coatings or layers, and etched or printed to define desired circuit traces. Signal planes 132, 134 may support a variety of surface mount components.

Please replace paragraph **[0137]** with the following paragraph:

[0137] Second, it is desirable to present a minimal magnetic load to the magnetic circuit operating on antenna 110. Reduction or elimination of surface area of conductive signal planes 132, 134 within the antenna aperture serves to reduce the magnetic load to the magnetic circuit of antenna 110. In other words, forming signal planes 132, 134 that define apertures in alignment with the aperture of antenna 110 can substantially reduce the magnetic load. The ground plane and signal plane features described herein may be especially suitable for antenna circuit board ~~104~~106, but may also be useful with display circuit board ~~106~~104.

Please replace paragraph **[0139]** with the following paragraph:

[0139] FIG. 24 is a plan view of a ground plane 130 for an antenna circuit board ~~1104~~106 as shown in FIG. 23. As shown in FIG. 24, ground plane 130 extends over dielectric layer 138. In particular, ground plane 130 is formed by a conductive layer 139 that extends over a substantial area of dielectric layer 138 in a substantially contiguous manner. To achieve a working compromise between RF and magnetic requirements, the single, contiguous ground plane 130 is, in effect, divided into smaller plane areas primarily to minimize magnetic loading of the antenna.

Please replace paragraph **[0140]** with the following paragraph:

[0140] The exact dimensions of each smaller plane area may not be critical to minimizing the loading. However, the desired effect of good RF and magnetic performance can be realized by incorporating a series of channel-like gaps 140A-140D (the various white lines in FIG. 24) that extend outward from an inner area of ground plane 130 toward outer edges of antenna circuit board ~~104~~106. Not all of the gaps are associated with reference numerals due to limitation in the black-on-white presentation of FIG. 24. The width of each gap 140 may vary, but can be on the order of approximately 0.2 to 3.0 mm.

Please replace paragraph **[0141]** with the following paragraph:

[0141] The spoke-like pattern of gaps may emanate from the center of antenna circuit board and extend outward toward the edges, interrupting the continuous ground plane and defining sub-areas. There is no conductive material in the gaps 140A-140D. These gaps 140A-140D divide adjacent conductive plane areas of ground plane 130 to prevent large eddy currents from forming around the perimeter of antenna circuit board ~~104~~106 in the conductive plane because there are no conductive loops around the perimeter of the board.

Please replace paragraph **[0143]** with the following paragraph:

[0143] FIG. 25 is a plan view of a first signal plane 132 for an antenna circuit board ~~104~~106 as shown in FIG. 23. FIG. 26 is a plan view of a second signal plane 134 for an antenna circuit board ~~104~~106 as shown in FIG. 23. First signal plane 132 is shown in conjunction with dielectric layer 136, while second signal plane 134 is shown in conjunction with dielectric layer 138. In the example of FIGS. 25 and 26, the respective signal planes 132, 134 may include conductive, electrostatic discharge (ESD) layers 142, 148, respectively.

Please replace paragraph **[0145]** with the following paragraph:

[0145] Both layers 142, 148 are dedicated to ESD protection of the antenna circuit board ~~104~~106 by deliberately bringing the copper out to the left and right edges 144, 146 of the board ~~104~~106 and connecting them to the main ground of the board only at the top and middle sections of copper. With this configuration, any ESD events have a known and controlled conductive path to main ground, and the disruptive effects of ESD are minimized. In the example of FIG. 25, the

top and bottom edges of the PCB are not as well protected from ESD as the left and right edges, but these areas are not flooded with copper to prevent magnetic loading effects, as described above.